JOURNAL OF APPLIED BEHAVIOR ANALYSIS 1991, 24, 747–761 NUMBER 4 (WINTER 1991)

INCREASING AUTISTIC CHILDREN'S DAILY SPONTANEOUS SPEECH

MARJORIE H. CHARLOP
CLAREMONT MCKENNA COLLEGE

AND

JANE E. TRASOWECH
CLAREMONT GRADUATE SCHOOL

We investigated the effectiveness of teaching parents of 3 autistic boys to use a time delay procedure to increase their children's appropriate spontaneous speech in several naturally occurring daily settings (e.g., saying "good morning" in the morning). Generalization across settings and within settings across persons and locations was assessed. Variation in the children's spontaneous speech was also assessed. In addition procedural errors in the parents' use of time delay were calculated. Results indicated that all children increased their daily spontaneous speech and generalized their speech to other locations and persons.

DESCRIPTORS: autism, time delay, spontaneous speech, language

Autistic children tend to speak only when spoken to and seldom initiate appropriate speech (Carr & Kologinsky, 1983; Lovaas, 1966). One procedure that has shown promise in increasing autistic children's spontaneous (self-initiated) speech is time delay (Charlop, Schreibman, & Thibodeau, 1985; Charlop & Walsh, 1986; Halle, Marshall, & Spradlin, 1979; Matson, Sevin, Fridley, & Love, 1990). In the first of a series of studies, Charlop et al. (1985) used time delay to teach autistic children to request desired objects spontaneously. Initially, the experimenter presented the target stimulus (e.g., a cookie) and immediately modeled the appropriate response (i.e., "I want cookie"). Once the child imitated the verbalization, the delay between the presentation of the target stimulus (cookie) and the prompt ("I want cookie") was gradually increased until the child spontaneously requested the object (spoke before the prompt). When this occurred, it was hypothesized that stimulus control had been transferred from the prompt (the experimenter's verbalization) to the target stimulus (cookie) (Touchette, 1971). Appropriate spontaneous speech has been defined as "a verbal response to a nonverbal discriminative stimulus in the absence of a verbal discriminative stimulus" (Charlop et al., 1985, p. 156; Charlop & Walsh, 1986; Matson et al., 1990). Thus, the child who initially spoke only in the presence of a verbal cue spoke spontaneously and appropriately in the presence of a physical nonverbal cue (a cookie).

Time delay has also facilitated generalization of appropriate spontaneous speech in that provisions for promoting generalization have been incorporated into the procedure (Stokes & Baer, 1977). For example, natural stimuli and functional behaviors were used in the above study (Charlop et al., 1985), and loose training and natural settings have been used in other studies (e.g., Charlop & Walsh, 1986; Halle et al., 1979; Schreibman, Charlop, & Tryon, 1981). Generalization has been promoted across objects (Charlop et al., 1985), settings (Charlop & Walsh, 1986), persons (Charlop et al., 1985; Matson et al., 1990), and situations (Halle et al., 1979; Schreibman et al., 1981).

This study is a thesis submitted by the second author to Claremont Graduate School in partial fulfillment for a Master of Arts degree in Psychology.

The authors thank the parents for their participation, and Michelle Henderson, Kurt Freeman, and Maluaka Harrison for assistance in transcribing and rating the children's speech recordings. We would also like to acknowledge Tim Collins, Ron Espinoza, and Brian Watkins for graphics, Susan Spitzer for assistance in data collection, and Patricia Kurtz and Janice Milstein for comments on earlier versions of this manuscript.

Reprints may be obtained from Marjorie H. Charlop, Department of Psychology, Claremont McKenna College, Claremont, California 91711.

Charlop et al. (1985) proposed a continuum of spontaneity for appropriate spontaneous speech in which the more discernible the controlling stimuli, the less spontaneous the response. Thus, at one end of the continuum is speech under the stimulus control of an obvious physical referent (e.g., a cookie), whereas the other end is represented by speech under the stimulus control of an internal, historical, or future event (e.g., hunger). In the series of studies using time delay, Charlop and her colleagues progressed along this continuum. First, Charlop et al. (1985) used time delay to teach appropriate spontaneous speech under the stimulus control of a physical referent (e.g., a cookie). Next, Charlop and Walsh (1986) taught autistic children to say "I like (love) you" spontaneously while hugging a familiar person (e.g., their mother). In this study, spontaneous speech was under the stimulus control of an activity (i.e., hugging). Progressing even further along the continuum, Schreibman et al. (1981) taught autistic children to spontaneously request appropriate items (e.g., slide at a playground). It is important to note that the specific playground equipment was not in the child's view. Thus, stimulus control was transferred from a verbal prompt ("I want slide") to an environment (the playground).

This previous research is encouraging because it suggests that autistic children's appropriate speech can become increasingly more spontaneous, perhaps approximating the speech of nonhandicapped children. The value of appropriate spontaneous speech is evident in that it naturalizes the children's speech, permits social interactions, and is a way for the children to obtain information, objects, food, and attention.

Whereas previous studies provided evidence of the efficacy of time delay, the present study was designed to provide a comprehensive analysis of parents' use of time delay to promote their autistic child's appropriate spontaneous speech. In addition, this study progresses further along the hypothesized continuum of spontaneity, in that daily events (cues based on time of day and setting, such as morning) corresponded with the appropriate verbalizations. Thus, this study's use of parents as trainers would perhaps not only facilitate generalization of appropriate spontaneous speech (e.g., Stokes & Baer, 1977) but would also test the assumption that the time delay procedure could be feasibly incorporated into the daily schedules of families. The study also extends previous literature in that (a) a more complex verbal response was trained, (b) procedural errors in the parents' use of time delay were assessed, and (c) a more extensive assessment of generalization and maintenance of appropriate spontaneous speech was performed.

METHOD

Subjects

Three autistic boys, attending biweekly sessions at an afterschool behavior modification program, participated in this study. All 3 boys were echolalic and were chosen to participate because they seldom displayed appropriate spontaneous speech. Child 1 was 7 years 9 months old and had a mental age of 7 years 2 months as measured by the Leiter International Scale. He spoke in full sentences, but spoke too rapidly with poor articulation, and his sentences were often inappropriate given the context. For example, instead of saying "hello" to his mother upon returning home from school, he might say "Thundercats are smart."

Child 2 was 8 years 7 months old and had a mental age of 6 years 6 months as derived from the Leiter International Scale. His speech was quite rote and consisted primarily of immediate and delayed echolalia. His appropriate greetings were rare.

Child 3 was 7 years 11 months old and had a mental age of 3 years 5 months as derived from the Evaluation and Prescription for Exceptional Children. His verbal skills were far less advanced than the other 2 children. Most of his speech consisted of two- to three-word responses to only a few questions (e.g., "I am fine" in response to "How are you?"). He rarely used appropriate greetings and demonstrated no other appropriate spontaneous speech.

Settings

For each child, settings that were part of the child's daily routine were chosen, and included four

Table 1
Settings and Target Phrases

Setting	Training setting description	Phrase
Child 1		
Morning	The first interaction of the day in the child's room.	Good morning, Mom.
After School	The first interaction after school as the child enters the house.	Hi Mom! I'm home.
Snack	Shortly after returning home from school in the kitchen.	May I have some ___ please?
Bedtime	In the child's room at his usual bedtime.	Goodnight, Mom.
Clinic arrival	As the child enters the observation room at the afterschool clinic.	Hi Jane.
Clinic departure	As the child leaves the observation room at the afterschool clinic.	See you later.
Child 2		
Morning	The first interaction of the day in the child's room.	Good morning, Mom.
Return	The child's mother returns home in the entryway.	Where were you Mom?
Dinner	While mother prepares dinner in the kitchen.	What's for dinner Mom?
Work	After dinner the child and his mother sit down to begin a work session in the living room.	I want to work for the ___.
Bedtime	In the child's room at his usual bedtime.	Goodnight, Mom.
Clinic arrival	As the child enters the observation room at the afterschool clinic.	Hi Jane.
Clinic departure	As the child leaves the observation room at the afterschool clinic.	See you later.
Child 3		
Bedtime	In the child's room at his usual bedtime.	Goodnight, Daddy.
Morning	The first interaction of the day in the child's room.	Good morning, Daddy.
Grandmother's house	Late afternoon as the parents enter grandmother's house to pick up the child.	Hi Daddy.
Bus	In front of the child's home as he gets on the school bus.	Bye-bye Daddy.
Clinic departure	As the child leaves the observation room at the afterschool clinic.	See you later.
Clinic arrival	As the child enters the observation room at the afterschool clinic.	Hi Jane.

or five home settings and two settings at the afterschool program. Settings were selected by discussing the child's daily routine with the parent (the child's mother for Children 1 and 2, and the child's father for Child 3) and choosing settings that (a) were a natural part of the child's daily activities, (b) occurred at a specific time of day, (c) provided a regular opportunity for the child to engage in spontaneous speech, and (d) were available to both the child and the parent.

To select a contextually appropriate phrase for each setting, the speech of 5 nonhandicapped peers was recorded in each setting. Then, the autistic child's parent and the experimenter chose target phrases that were typical of the nonhandicapped peers and were in keeping with the parent's wishes. Settings and phrases for each child are described in Table 1. The order of time delay implementation in each setting for Children 1 and 2 was the order in which these daily settings naturally occurred. However, for Child 3, the order of presentation of time delay was chosen randomly to control for any potential order effects.

Design

A multiple baseline design across children and settings was used. During baseline, speech recordings were made by the parent to determine the frequency of appropriate spontaneous speech. Following baseline, the parents implemented a grad-

uated time delay procedure in the first setting. After criterion was reached, time delay was implemented in the next setting, and so on. If generalization in the next setting occurred, then time delay was considered unnecessary. Finally, maintenance data were collected for about 1 year in each setting after criterion was reached. During baseline and maintenance, probes were conducted by the parent in other locations within each setting (e.g., for the morning setting, in rooms other than the child's room, such as the bathroom) and with untrained family members in trained and untrained locations.

Dependent Measures

The children's verbalizations in the daily settings were scored as either spontaneous speech, imitations, or incorrect.

Spontaneous speech. Spontaneous speech was defined as appropriate speech that is "a verbal response to a nonverbal discriminative stimulus in the absence of a verbal discriminative stimulus" (Charlop et al., 1985, p. 156). Only contextually appropriate speech was scored as spontaneous speech. Thus, two important clarifications are necessary. First, although inappropriate speech (e.g., delayed echolalia, perseverative speech, and other bizarre verbalizations) can be considered spontaneous (without a verbal discriminative stimulus), it was not scored as spontaneous speech because it was clearly not appropriate speech and was not a target response. Second, only spontaneous speech appropriate to the context was scored. Although there may be a variety of utterances spoken by autistic children that may be considered appropriate (e.g., a full sentence) as well as spontaneous (no verbal cue), this in itself was not the target of our study. For example, one child in the morning setting said, "Lightning bolts can hurt you." Another child said "goodnight" in the morning setting. These were scored as incorrect responses.

Imitation. Imitation was scored if the child immediately repeated all or most of the modeled response.

Incorrect. Incorrect speech was scored if the child made any inappropriate verbalization or any verbalization that was not spontaneous. Appropriate speech made after a verbal discriminative stimulus that was not an imitation (e.g., answer to a question) seldom occurred and was scored as incorrect because it was not spontaneous.

Response variation. Response variation was defined as the first occurrence of an utterance that differed from any previous utterance (trained or untrained) by one word or more. For example, if the child consistently said "goodnight, Mom" in the bedtime setting, one varied response was counted the first time the child said "pleasant dreams, Mom" instead.

Recall that the speech of 5 nonhandicapped peers was recorded in each setting. Specifically, parents of the nonhandicapped peers were taught to record their children's speech in the chosen settings in the same manner that the parents of the autistic children were taught to record their children's speech during baseline. From the transcripts of the nonhandicapped children's speech recordings, appropriate phrases for each setting were chosen, and comparisons of response variation of the autistic children with the nonhandicapped peers' variation were made later.

Procedure

In all conditions, parents used a microcassette recorder to obtain speech recordings. Before entering the setting and recording a trial, the parent recorded the date, setting, and location. The parent turned off and hid the recorder (to prevent the child's responding to the presence of the recorder). The parent then entered the setting, kept the recorder hidden, established eye contact with the child, unobtrusively turned on the hidden recorder, and the trial began.

Baseline. Speech recordings were obtained daily by each parent in each home setting to determine the baseline frequency of appropriate spontaneous speech. First, parents were instructed to allow their child the opportunity to engage in spontaneous speech by approaching their child without saying anything for several seconds. The parents were then instructed to prompt their child's speech by implementing traditional prompting procedures (e.g., "Say ___"; "You need to say ___") in each setting.

For example, each night at bedtime, the parent might say, "Tell me goodnight," or "What do you need to say?" For the clinic settings (arrival and departure), which occurred twice a week, the parents presented the prompts while the experimenter recorded. When time delay was presented in the first setting, recordings were continued in all other settings.

The speech recordings revealed that during the first 2 months of baseline, Child 2's mother did not provide any prompting of her child's speech as instructed. Rather, she merely approached her child and waited for his spontaneous speech. This baseline period, as expected, showed no appropriate spontaneous speech. Thus, Child 2's mother was given a special prompting program to determine whether her child would eventually acquire appropriate spontaneous speech with traditional prompting procedures. Child 2's mother was thus specifically instructed to implement the traditional prompting procedure in all settings on two specified days per week and was encouraged to do this every day.

Parent training. Following baseline, time delay training, consisting of instruction, modeling, and feedback, took place at the afterschool program. During the initial training session, the experimenter explained the graduated time delay procedure, including the steps in the procedure, the delay schedule, and the definitions of correct and incorrect responses. In addition, the experimenter trained the parent to use time delay in the first setting. Subsequent training (i.e., specific instructions for each setting) occurred approximately 2 days before implementing time delay in each of the other settings.

During each training session, the experimenter modeled the graduated time delay procedure with an adult, using the target phrase for that particular setting (e.g., "goodnight, Mom" for bedtime). A series of hypothetical examples was provided, which required the parent to judge whether the child's responses were correct or incorrect and when to proceed to the next increment (e.g., when to move from a 2-s delay to a 4-s delay). Next, the parent role-played his or her use of graduated time delay for that particular setting with the experimenter acting as the child. Then, the experimenter provided feedback on the parent's use of time delay and modeled the procedure again, focusing on problem areas. Once the parent implemented the procedure correctly on three consecutive practice trials, time delay was implemented in that setting.

Time delay. A graduated time delay using 2-s increments was used. Initially, the parent modeled the correct response for the child to imitate immediately (0-s delay). For example, in the morning setting, the parent said "good morning, Mommy" as soon as she made eye contact with the child. When the child imitated this (repeated "good morning, Mommy") for two consecutive mornings, a delay of 2 s was presented between the start of the episode (when the parent entered the child's room, established eye contact, and clicked on the hidden microcassette recorder) and the presentation of the modeled response, "good morning, Mommy." After two consecutive correct responses at the 2-s increment, the parent moved to the 4-s increment, and so on. A correct response occurred when the child was spontaneous (spoke before the prompt) with any trained or untrained contextually appropriate response, or when he imitated the prompt. An appropriate response (e.g., "good morning to you, too") and verbal praise were provided by the parent for correct responses. An incorrect response occurred when the child did not imitate the prompt or provided a contextually inappropriate spontaneous verbalization. When an incorrect response occurred, the parent did not respond to the child and repeated the same delay the next day when the next trial occurred. Criterion performance for each setting was defined as five consecutive spontaneous responses at the 10-s delay. Once criterion was reached in the first setting, time delay was implemented in the next setting in which generalization had not yet occurred. This procedure continued across settings until time delay had been presented in all necessary settings (those in which generalization had not occurred).

During time delay, the parent turned the recorder on again as soon as time delay began (when eye contact was established). Hence, the experimenter heard two clicks on the recording: the first

when the recorder was turned off (after the date, setting and location), and the second when the recorder was turned on again (when time delay began). This enabled the experimenter to measure the length of the delay by timing the interval from the second click until the parent provided a prompt or the child spoke, or until 10 s elapsed.

Maintenance. After criterion was reached in a particular setting, the child was consistently presented with a 10-s delay in that setting. If no response occurred before 10 s elapsed or if an incorrect response occurred, it was scored as incorrect. Weekly maintenance probes were taken for 1 month, followed by monthly probes for 6 months, followed by semiannual probes for 1 year.

Generalization Probes

The children's generalization of spontaneous speech within each setting was assessed via probes conducted during baseline and maintenance. During all probes, the child was allowed 10 s to engage in a verbal response.

Locations. Probes across locations within each setting were conducted by the parent in untrained locations. For example, the morning probe occurred in another room where the parent and the child first saw each other (e.g., the bathroom or the TV room) instead of the child's bedroom.

Persons. These probes were conducted with other family members in the trained location for each setting. For example, the child's brother, instead of his mother, conducted the bedtime probe.

Locations and persons. These probes were conducted with other family members in untrained locations.

Reliability and Rater Training

The experimenter (the second author) transcribed and timed the microcassette recordings, scored the responses (spontaneous, imitation, or incorrect), and checked for procedural errors and response variation. A trained rater independently performed these same procedures for reliability purposes. Interrater reliability for all measures was calculated by dividing the total number of agreements between the experimenter and the rater by the number of agreements plus disagreements and multiplying by 100.

A previously transcribed tape, which was not included in reliability calculations, served as the training tape for transcript and timing training. The experimenter's actual transcript was used for response scoring, response variation, and procedural errors (other than timing errors) during rater training. For each measure, the experimenter provided instructions, practiced the procedure (e.g., transcribing, timing, response scoring) with the rater, and discussed any questions. Then, the rater performed the procedure independently, using a different training tape or transcript. A criterion was set for each measure for training interrater reliability.

Transcripts. Specific training instructions were as follows: Write down word for word what is heard on the tape. If a word or phrase is unclear, listen to the word or phrase no more than three times, then record as unintelligible. Criterion for training was 80%. Interrater reliability was calculated by comparing the experimenter's and rater's transcripts, verbalization by verbalization. A verbalization was defined as a speaker's turn (either parent or child) in an interaction. If 90% or more words were identical between the experimenter's transcribed verbalization and the rater's transcribed verbalization, the verbalization was considered an agreement. Transcript reliability for all settings averaged 85% for Child 1 (range, 75% to 100%), 89% for Child 2 (range, 76% to 100%), and 86% for Child 3 (range, 75% to 100%).

Timing. To assess the accuracy of the reported time delays, the rater's scoring of the time delays was compared to the experimenter's scores. The rater was trained to time an individual trial by calculating the time from the second click (when the trial began) until the parent provided a prompt, the child spoke, or 10 s elapsed. The criterion for training was 90%. Interrater reliability was calculated by comparing the rater's and experimenter's reported delay for each trial. If the reported delays were within 1 s of each other, the trial was considered an agreement. Timing reliability was 87%

for Child 1, 94% for Child 2, and 94% for Child 3.

Response scoring. The rater also scored each response as spontaneous, imitation, or incorrect. Training began by providing the rater with the definitions of spontaneous, imitation, and incorrect responses and examples of each. The criterion for training was 90%. Interrater reliability was calculated by comparing the rater's and experimenter's scores, trial by trial. If the scores matched for a given trial, the trial was considered an agreement. The scoring reliability across all settings averaged 97% (range, 89% to 100%) for Child 1, 99% for Child 2 (range, 88% to 100%), and 90% (range, 64% to 100%) for Child 3.

Response variation. Using the experimenter's transcripts, the rater listed the date, setting, occurrence or nonoccurrence of variation, and response (if varied) for each trial. Training included providing the rater with the definition of a varied response and a number of examples. The criterion for training was 90%. Interrater reliability was calculated by comparing the experimenter's and rater's lists, trial by trial. If the date, setting, occurrence or nonoccurrence of variation, and response (if varied) matched for a given trial, it was considered an agreement. Mean percentage of agreement for response variation reliability for each child across all settings was 93% for Child 1 (range, 87% to 100%), 93% for Child 2 (range, 89% to 100%), and 95% (range, 86% to 100%) for Child 3.

Procedural Integrity

The frequency of the parents' procedural errors during time delay and maintenance was determined from the microcassette recordings. Procedural errors occurred when the parent incorrectly presented the time delay procedure. Multiple errors could occur during one trial. Possible procedural errors included (a) difference of 2 or more seconds between correct and actual delay time, (b) providing the time delay prompt more than once on a trial, (c) providing prompts despite the occurrence of the child's contextually appropriate spontaneous speech, and (d) prompt is provided or 10 s are not allowed for the child to respond during maintenance.

For reliability, the rater, using the experimenter's transcripts, listed the date, setting, occurrence or nonoccurrence of an error, and type of error (if any), for each trial. Training consisted of providing the rater with the types of procedural errors and examples. The criterion for training was 90%. Interrater reliability was calculated by comparing the experimenter's and rater's lists, trial by trial. If the date, setting, occurrence or nonoccurrence of an error, and type of error (if any) matched for a given trial, it was considered an agreement. Procedural integrity reliability across settings was a mean of 95% (range, 90% to 100%) for Child 1, 96% (range, 86% to 100%) for Child 2, and 97% (range, 93% to 100%) for Child 3.

RESULTS

The results for Children 1, 2, and 3 are shown in Figures 1, 2, and 3, respectively. Percentages of spontaneous, imitated, and incorrect responses are shown. The data are plotted by monthly intervals or by number of weeks within each month that data were collected. Typically, percentages of occurrence of the three behaviors were collected for a full month. However, on some occasions (usually during maintenance), data were collected during a few weeks of a particular month but not for the entire month. Thus, if 1 week of data within a monthly interval was collected, the data points appear at the first small hash mark. If data were collected for 2 weeks out of the month, the data points appear at the second small hash mark within that monthly interval. Finally, if 3 weeks of data were collected during a month, the data points are plotted at the third small hash mark. If a full month of data was collected, the data points are plotted at the large hash mark.

During baseline, the children rarely engaged in spontaneous speech. With the introduction of time delay, the children quickly acquired and maintained contextually appropriate spontaneous speech. Generalization across settings was limited. The criterion for generalization was five consecutive contextually appropriate spontaneous responses within a 10-s period. However, all 3 children generalized within

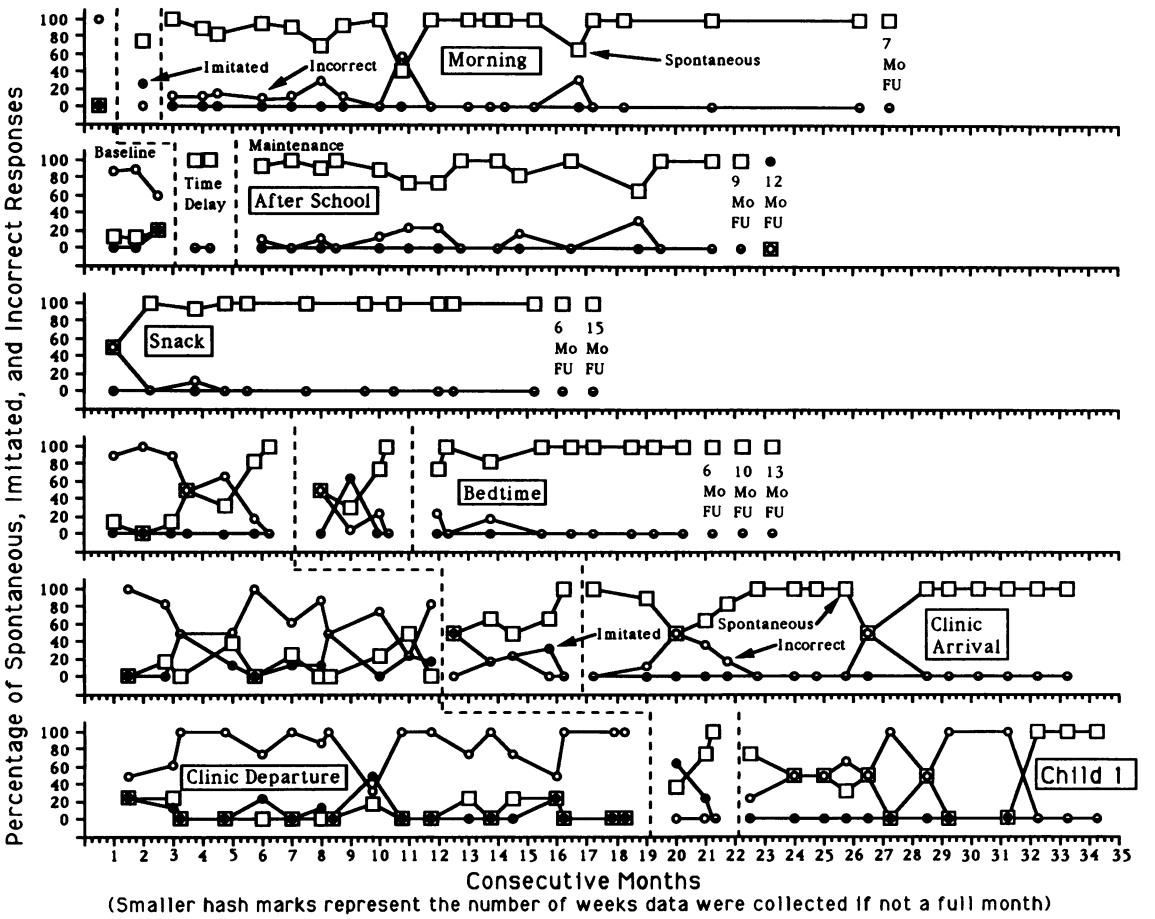

Figure 1. Monthly percentages of spontaneous, imitated, and incorrect responses for Child 1. If a full month of data was collected, the data appear at the large hash mark. If less than a full month of data was collected, the data appear at the small hash mark corresponding to the number of weeks data were collected.

settings across persons, locations, and both persons and locations.

During baseline in the morning setting, Child 1 engaged in no spontaneous speech. Once time delay was introduced, criterion performance was reached and spontaneous speech maintained (Figure 1). In addition, generalization occurred to the snack setting (Figure 1). Time delay was then implemented in the afterschool setting and next in the bedtime setting. Although Child 1 engaged in some spontaneous speech during baseline in the clinic arrival setting, intervention was necessary. Finally, time delay was implemented successfully in the departure setting. Contextually appropriate spontaneous speech was maintained in all settings.

As mentioned earlier, initial data for Child 2 (which do not appear in the figure) demonstrated that his mother merely turned on the recorder but made no attempt to prompt his speech. During baseline with the special prompting program (Figure 2), Child 2 often imitated the prompts but did not acquire spontaneous speech. Upon implementation of time delay in the morning setting, criterion was quickly reached and spontaneous speech was maintained. Time delay was then implemented successfully in the return setting. Child 2's spontaneous speech increased in the dinner setting, suggesting that some generalization may have occurred, but his speech was not consistently spontaneous; thus, time delay was subsequently provided. Generaliza-

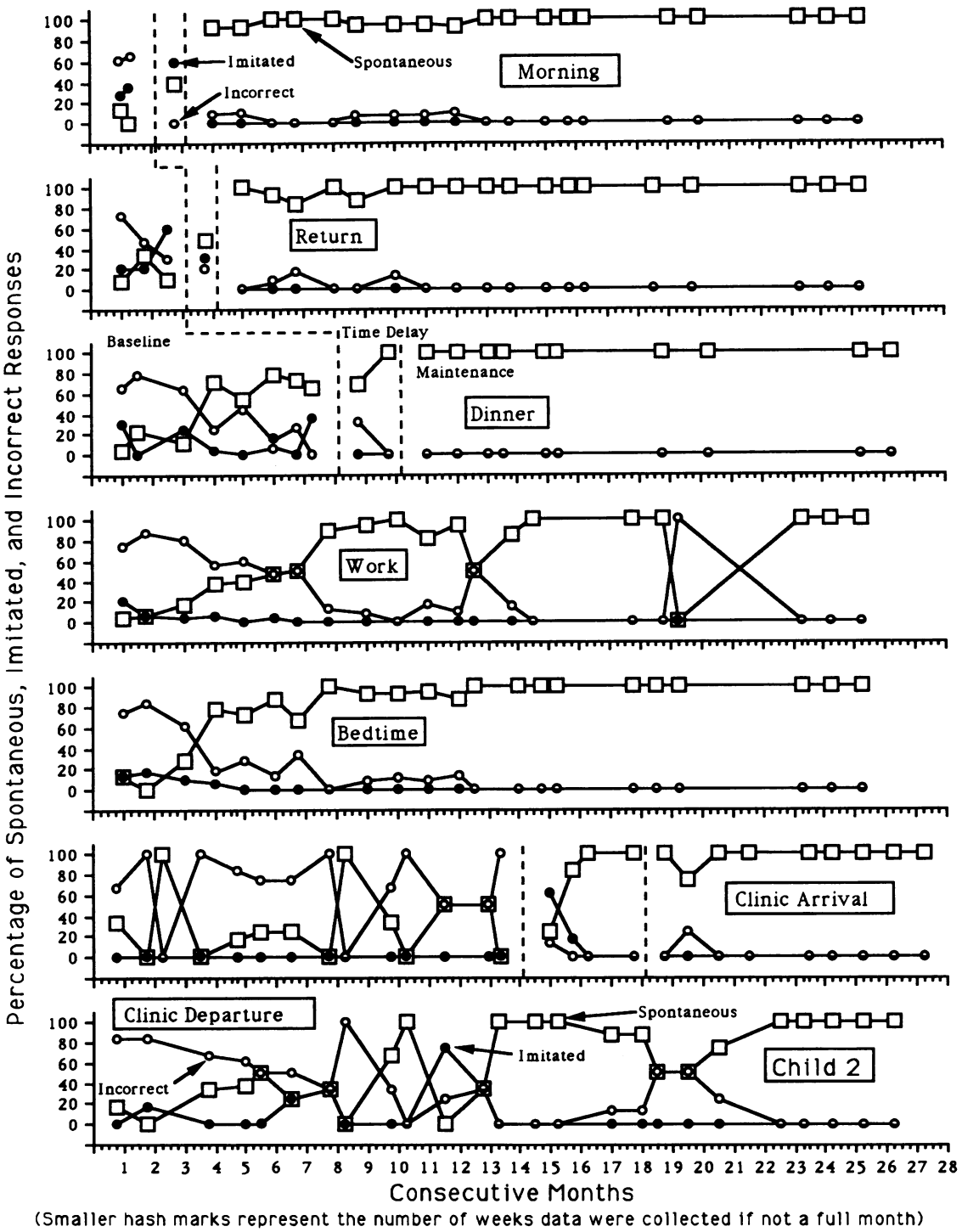

Figure 2. Monthly percentages of spontaneous, imitated, and incorrect responses for Child 2.

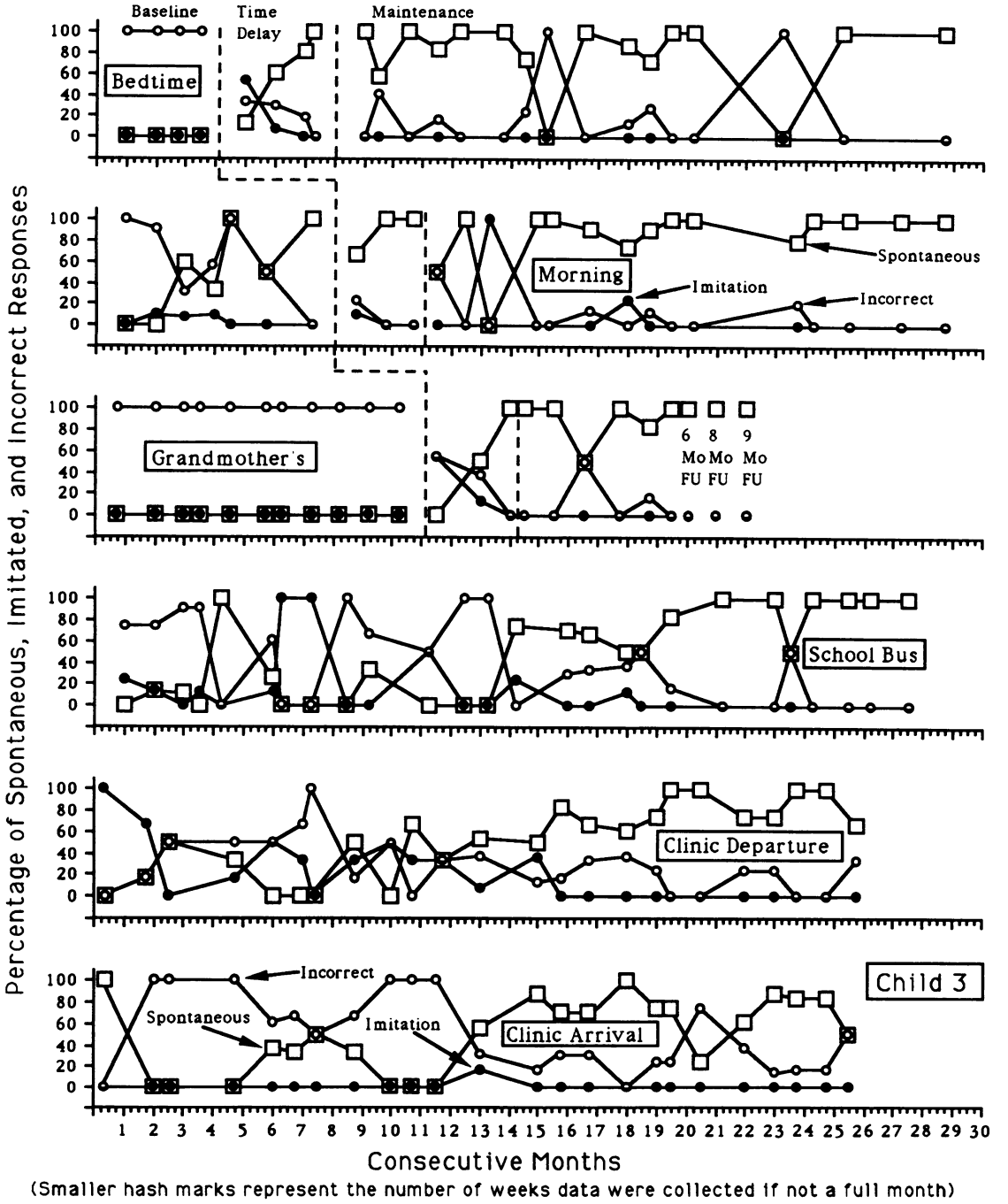

Figure 3. Monthly percentages of spontaneous, imitated, and incorrect responses for Child 3.

tion then occurred to both the work and bedtime settings. During baseline for clinic arrival, Child 2 engaged in some spontaneous speech; however, after time delay was introduced, Child 2 acquired spontaneous speech, and generalization occurred to the clinic departure setting (Figure 2). Maintenance of contextually appropriate spontaneous speech occurred in all settings.

Child 3 engaged in no spontaneous speech during baseline in the bedtime setting. When time delay was introduced, spontaneous speech rapidly increased and criterion was reached. Child 3 engaged in some spontaneous speech during baseline in the morning setting; however, when time delay was implemented, the criterion was quickly reached. Time delay was then successfully implemented in the grandmother's house setting, and generalization occurred in the clinic arrival, clinic departure, and bus settings. Contextually appropriate spontaneous speech was maintained in all settings.

Generalization Probes

Probes for generalization within each setting across persons, locations, and persons and locations for each child are presented in Figure 4. Probes for Child 1 indicated that generalization occurred in the bedtime, clinic arrival, and clinic departure settings (baseline data were not obtained in the other settings). Probes for Child 2 indicated that generalization occurred in the dinner, work, bed, clinic arrival, and clinic departure settings. Child 3 generalized across persons and locations in all six settings.

Response Variation

Variation in responses for the children and 5 nonhandicapped peers is shown in Table 2. For each setting, the ratio of varied spontaneous responses to total spontaneous responses (including varied spontaneous responses) and the ratio of nonspontaneous responses to total responses (nonspontaneous and spontaneous) are shown. For the nonhandicapped peers, the data are not reported by condition. The target children either slightly increased their number of varied responses from baseline to time delay and maintenance or maintained a stable but low frequency of response variation. The children's response variation was relatively low when compared with that of the nonhandicapped peers. After time delay, the autistic children's ratio of spontaneous to nonspontaneous responses was generally higher than that of the nonhandicapped controls.

Procedural Errors

The frequency of procedural errors made by the parents during time delay and maintenance was quite low. Parent 1 made 21 errors in 100 trials during time delay and only 15 errors in 349 trials during maintenance. Parent 2 made eight errors in 72 trials during time delay and only eight errors in 450 trials during maintenance. Parent 3 made 22 errors in 81 trials during time delay and 21 errors in 315 trials during maintenance.

DISCUSSION

This study demonstrated the efficacy of teaching parents of 3 autistic boys to use a time delay procedure to increase their children's daily spontaneous speech in the natural environment. In general, the target behavior generalized within settings across locations, persons, and locations and persons. This study provides additional data that progress further along the continuum of spontaneity proposed by Charlop et al. (1985). Importantly, the children learned quickly, and spontaneous speech was maintained over a period of up to 30 months. In fact, the children usually learned spontaneous speech within a few weeks. Such rapid acquisition is consistent with previous research (e.g., Zane & Handen, 1987) and may have occurred, in part, because time delay takes advantage of the children's immediate echolalia (Charlop, 1983; Charlop et al., 1985). In time delay, the tendency to echo may have increased the likelihood of responding to the parent's modeled response (e.g., "good morning, Mommy"). Initially, an echolalic response was a correct response. As the increments in the time delay procedure increased, this echolalic response was transformed to contextually appropriate speech. The children's echolalic response may be similar to what Skinner (1957) termed "echoic behavior" in that it is a verbalization matching a preceding verbal stimulus and is reinforced (in this case, by the child's parent). Furthermore, what originally started as echoic behavior may have then led to what Skinner described as "self-echoic" behavior (Skinner, 1957). In our study, the children initially ech-

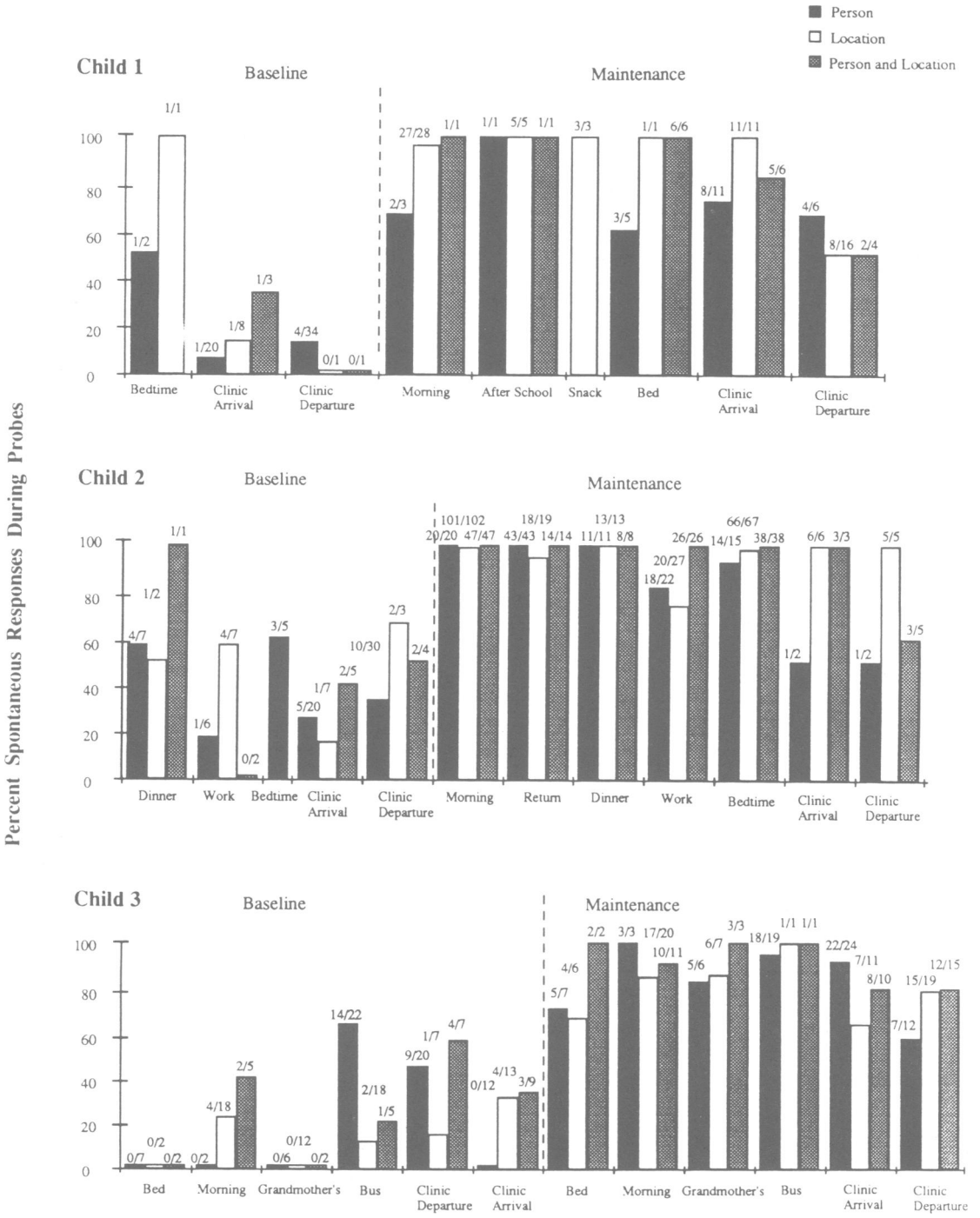

Figure 4. Percentage of spontaneous responses during baseline and maintenance probes with other persons, locations, and persons and locations.

Table 2

Varied Spontaneous/Total Spontaneous Responses and Nonspontaneous/Total Responses for Child 1, Child 2, and Child 3 and Nonhandicapped Peers

Setting	Varied spontaneous/total spontaneous		Nonspontaneous/total	
	Baseline	Time delay and maintenance	Baseline	Time delay and maintenance
Child 1				
Morning	0/0	24/149	10/10	18/167
After school	2/2	13/102	25/27	13/115
Snack	0/0	21/43	6/6	1/44
Bedtime	8/12	6/44	38/50	8/52
Clinic arrival	3/9	9/47	42/51	14/61
Clinic departure	4/6	1/22	65/71	9/31
Child 2				
Morning	1/2	22/224	21/23	12/236
Return	1/2	12/167	31/33	10/177
Dinner	7/42	8/108	48/90	3/111
Work	18/18	27/58	44/62	14/72
Bed	4/18	19/129	41/59	9/138
Clinic arrival	6/11	8/15	35/46	6/21
Clinic departure	5/12	7/16	33/45	4/20
Child 3				
Bedtime	0/0	18/60	27/27	32/92
Morning	5/14	20/77	43/57	19/96
Grandmother's	2/2	3/34	31/33	12/46
Bus	6/22	2/26	56/78	3/29
Clinic departure	6/12	2/48	41/53	13/61
Clinic arrival	7/13	5/46	50/63	12/58
Nonhandicapped Peers				
Morning	22/23		22/45	
After school	11/12		13/25	
Snack	9/10		1/11	
Dinner	23/24		3/27	
Bed	15/15		39/54	

oed their parent's verbal stimulus, but later may have echoed their own verbalization. Self-echoic behavior has self-reinforcing properties (Skinner, 1957) that may have enhanced both acquisition and generalization of the children's verbal behavior. The time delay also may have taken advantage of the children's tendency to engage in ritualistic behavior (e.g., Kanner, 1949), in that the children said a certain target phrase at a certain time of day.

The results of the within-setting generalization probes during maintenance were encouraging and suggest that the children's speech generalized to other appropriate situations and was not exclusively under the stimulus control of specific cues (e.g., the trainer or the specific training location). For example, in the bedtime setting, it was dark outside, the child was in his pajamas in the family room, possibly feeling tired, and his mother had just finished reading him a story. Cues such as these may have prompted the child to say, "goodnight, Mommy." Thus, it is possible that the children's spontaneous speech could also be under temporal and other general time-bound environmental cues. In some instances, the children engaged in spontaneous speech before the parent entered the room, suggesting their speech was not under the stimulus control of parents.

In comparison to the within-setting generalization data, generalization across the targeted settings was somewhat more limited. What generalization

did occur (in one setting for Child 1 and three settings for Children 2 and 3) was perhaps due to the use of multiple exemplars inherent in the design (Stokes & Baer, 1977). Training in several settings perhaps contributed to the acquisition of appropriate spontaneous speech in the remaining settings. Also, some limited response generalization is suggested by the transcripts. In fact, the transcripts often showed generalization to settings in which the parents failed to use time delay procedures. This finding, in addition to the strong within-setting generalization data, suggests the children's speech was not merely a function of their parents' behavior.

Comparing the speech of the autistic children and the nonhandicapped peers yielded some interesting findings. The autistic children were spontaneous more frequently after time delay than were the nonhandicapped peers. This, of course, should be interpreted with caution, because the nonhandicapped peers were most likely spontaneous at times other than at the recorded times, whereas the autistic children, in general, were seldom spontaneous in any setting before time delay. However, when comparing the response variation data, only small increases in response variation were noted for the autistic children after time delay, whereas response variation was stable and more frequent for the nonhandicapped peers. The nonhandicapped peers, with more sophisticated verbal repertoires, responded with a variety of very specific responses in each setting. This suggests the need for further research to facilitate response variation.

The benefits of teaching spontaneous speech to autistic children are evident. However, some may argue that the limited response variation suggests the children were merely engaging in conditioned responses and didn't really "know" what they were saying. It is, of course, difficult to refute this argument, but even if correct, the production of such conditioned responses is valuable in that it makes the child appear more communicative and social.

Our data raise some suggestions for future research. First, to improve generalization, the present study should be extended to include more multiple exemplars in the form of multiple trainers in multiple locations within each setting. Second, to enhance response variation, the present study should be extended to include multiple exemplars in the form of multiple phrases. For example, four phrases instead of one could be taught in the bedtime setting: "goodnight," "pleasant dreams," "sleep tight," and "see you in the morning."

Our results suggest that time delay is an effective procedure to increase autistic children's daily spontaneous speech in natural settings. Parents were easily taught, and it was feasible to use time delay during everyday home-life. Additionally, this study progressed along the continuum of spontaneity to a point at which no obvious physical cues were present. These results are quite promising and suggest the need for future research moving even further along the continuum to a point at which speech is under stimulus control of a future, historical, or internal event.

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Received July 13, 1990
Initial editorial decision September 10, 1990
Revisions received December 31, 1990; February 22, 1991
Final acceptance August 5, 1991
Action Editor, David P. Wacker